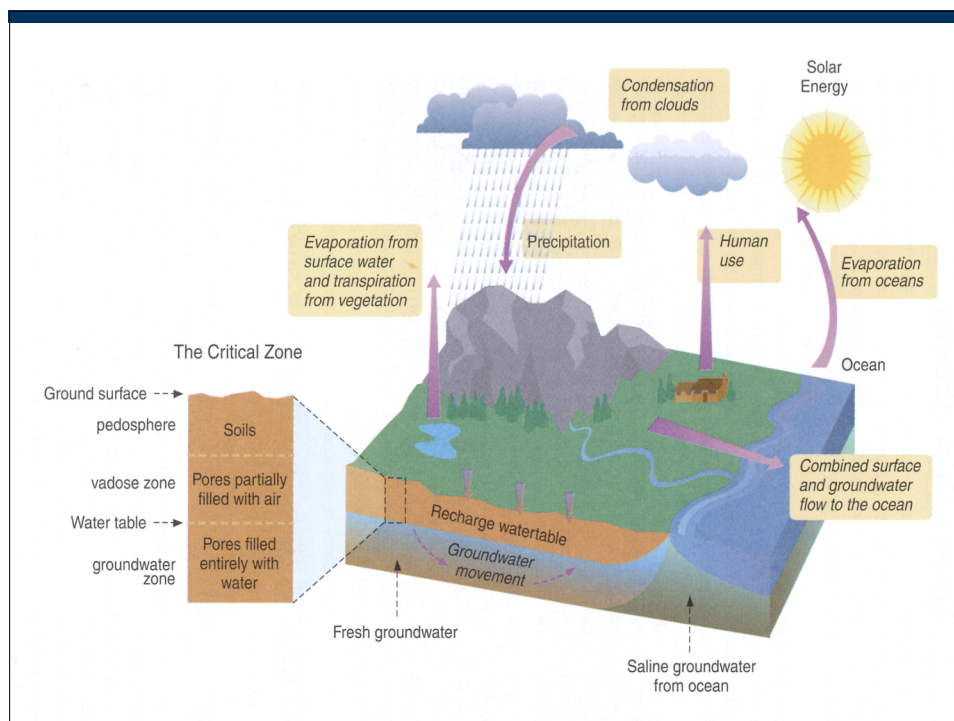
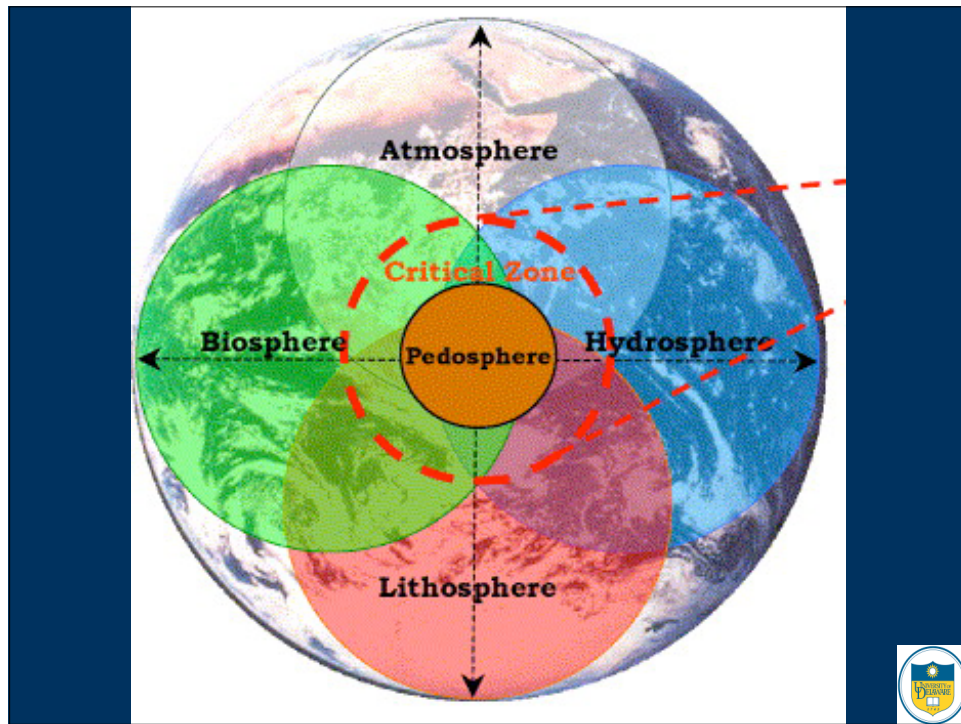


# COMPLEX ENVIRONMENTAL SYSTEMS / ECOSYSTEM HEALTH

Delaware Council on Science and Technology Meeting  
DBI, Newark, DE  
October 4, 2005

Donald L. Sparks

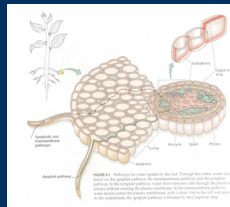




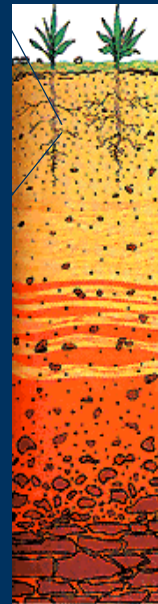
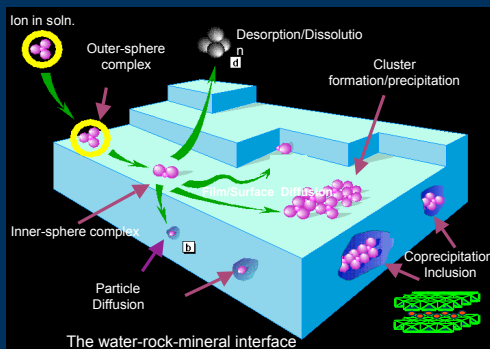
## *It's About Interfaces!*



The microbe-mineral interface

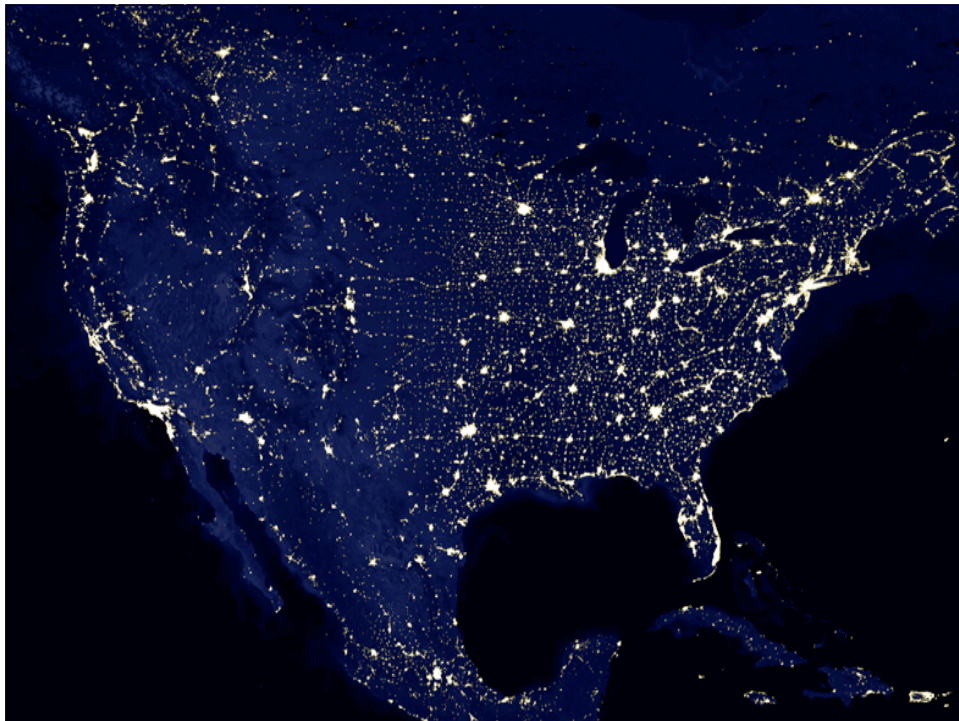


The root-soil interface



## *IMPACTS OF ECOSYSTEM HEALTH*

- Human Health and Quality of Life
- Air, Soil, and Water Quality
- Health of Oceans
- Global Climate Change
- Biodiversity
- Economic Viability and Development





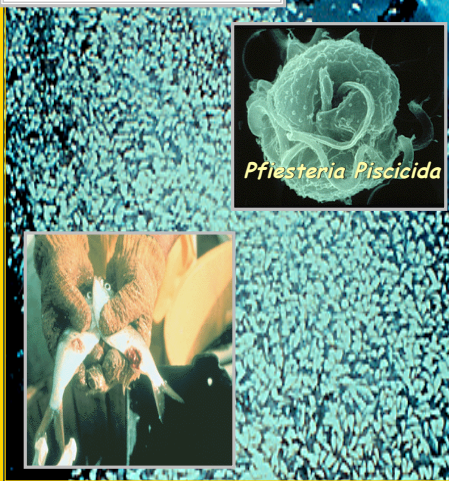


## Nutrient Management: Human and Ecosystem Health

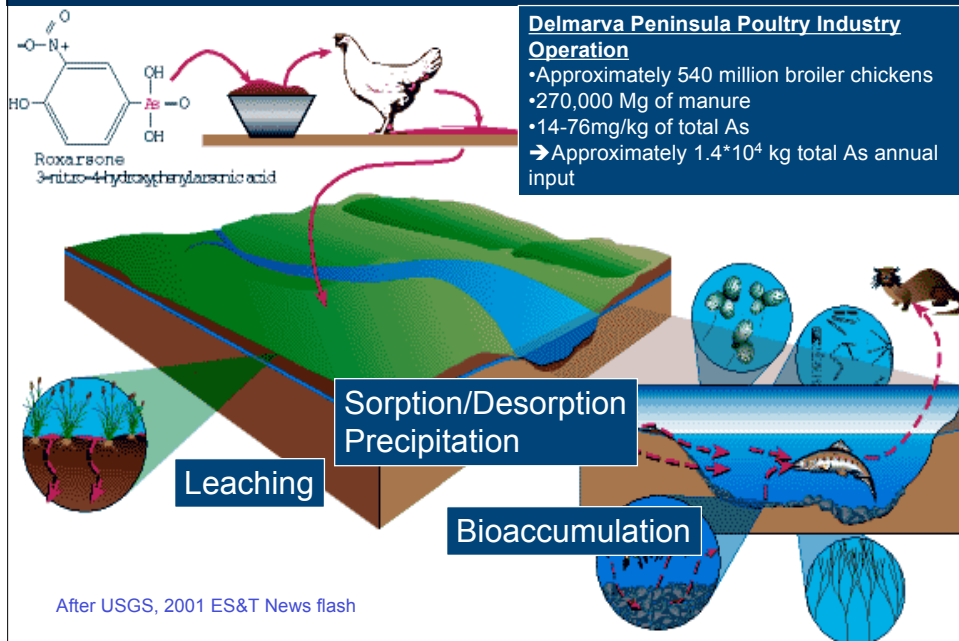
Nuisance seaweed blooms  
in Delaware's Inland Bays



Fish kills  
Harmful algal blooms



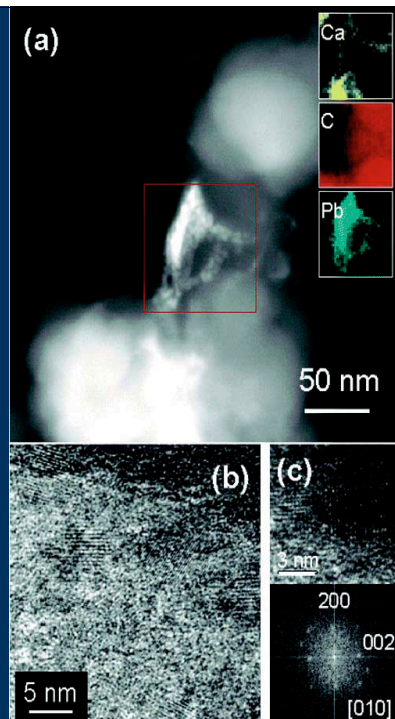
## Fate and Transport of Roxarsone in Soil/Water Environments

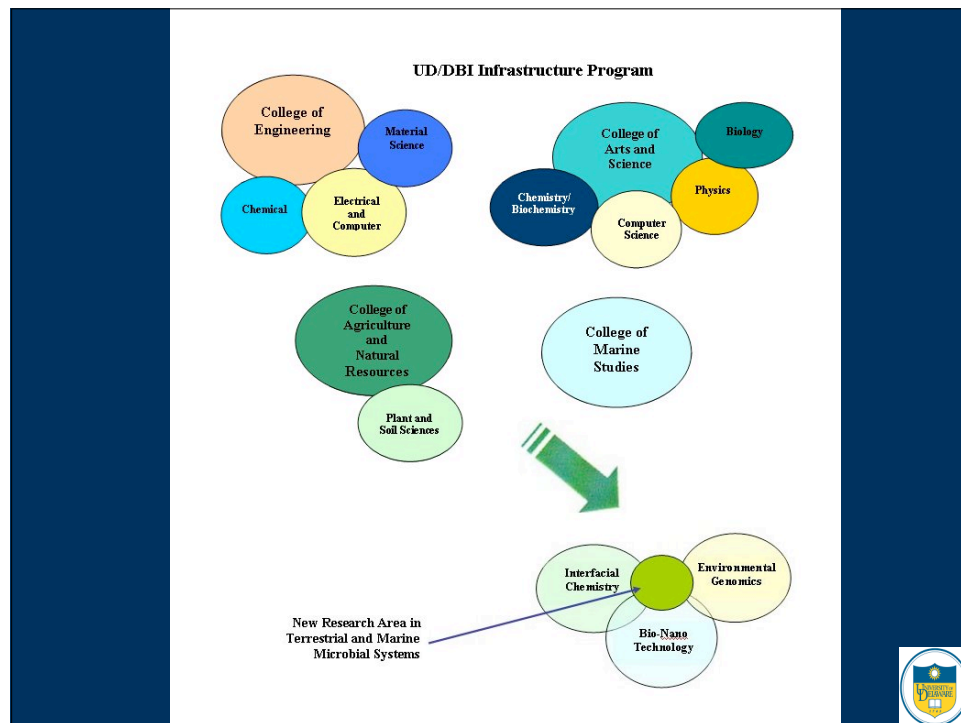


(a) TEM image and elemental maps of a Pb-bearing nanoparticle from urban aerosols.. The nanoparticle is associated with the surface of unidentified carbonaceous matter.

(b) High Resolution (HR)TEM image of the Pb-bearing nanoparticle showing that it is an aggregation of particles that range down in size to a few nanometers.

(c) HRTEM and Fast Fourier Transferred image used to identify the nanoparticles as PbO.





## **OBJECTIVES OF RESEARCH PROGRAM**

- 1) Increase Capability in Environmental Genomics and Interfacial Chemistry
- 2) Develop a Fundamental Research Competency in Bionanoscience and Engineering
- 3) Integrate 1) and 2) into a New, Interdisciplinary Area of Research Focused on Terrestrial and Marine Microbial Systems.



## *RESEARCH THRUSTS*

### Environmental Genomics

Natural Microbial Communities (Meta or Community Genomics)

### Interfacial Chemistry

Role of interfacial reactions in natural systems

### Bionanoscience and Engineering

Exploiting knowledge of biology, chemistry, physics and nanotechnology to build novel bionanodevices



## *TOOLS*

- Molecular Biology (Genomic Technologies)
- Environmental Biogeochemistry (Surface Spectroscopy/Microscopy)
- Nanoscience and Engineering (Nanoscale Biosensors)



## *Ultimate Goals*

 Center for Molecular Environmental  
Science and Technology

 Material Research Science and  
Engineering Center

